I CLAIM:

1. A photodetector, comprising:

a monocrystalline Si well of a first conductivity type, wherein said well has a surface plane, and wherein said well contains at least one trench downwardly extending from said surface plane;

an undoped epitaxial layer lining said at least one trench, wherein said undoped epitaxial layer comprises a $Si_{1-x}Ge_x$ layer with $0<x\leq 1$, wherein said $Si_{1-x}Ge_x$ layer has a thickness which is below a critical thickness, wherein a cross sectional surface of said undoped epitaxial layer forms a band which is substantially aligned with said surface plane; and

a second material of a second conductivity type disposed over said undoped epitaxial layer but not in contact with said band.

2. The photodetector of claim 1, wherein said at least one trench has a depth which is larger than said critical thickness.

3. The photodetector of claim 1, wherein said at least one trench has a sidewall which is substantially perpendicular to said surface plane.

4. The photodetector of claim 1, wherein said second material substantially fills up said at least one trench.

5. The photodetector of claim 1, wherein said second material is selected from the group consisting of monocrystalline Si in epitaxial relation with said undoped epitaxial layer, polycrystalline Si, amorphous Si, polycrystalline SiGe, amorphous SiGe, polycrystalline Ge, amorphous Ge, and their combinations thereof.

6. The photodetector of claim 1, wherein said $Si_{1-x}Ge_x$ layer is essentially pure Ge.

7. The photodetector of claim 1, wherein said undoped epitaxial layer consists essentially of $Si_{1-x}Ge_x$.

8. The photodetector of claim 1, wherein said first conductivity is p-type and said second conductivity is n-type.

9. The photodetector of claim 1, wherein said first conductivity is n-type and said second conductivity is p-type.

10. The photodetector of claim 1, further comprising a first electrical contact to said Si well and a second electrical contact to said second material.

11. The photodetector of claim 1, wherein said Si well has a first doping level, and wherein said Si well is in contact with a monocrystalline Si body of said first conductivity type, wherein said Si body has a second doping level, and wherein said first doping level is higher than said second doping level.

12. The photodetector of claim 1, wherein said Si well has a first doping level, and wherein said Si well is a monocrystalline Si body.

13. The photodetector of claim 1, wherein said Si well is in contact with a monocrystalline Si body of said second conductivity type.

14. A method for fabricating a photodetector, comprising the steps of:

growing by lateral epitaxy an undoped layer lining a trench, wherein said trench is in a monocrystalline Si well of a first conductivity type, wherein said undoped epitaxial layer comprises a $Si_{1-x}Ge_x$ layer with $0<x\leq 1$, and wherein said $Si_{1-x}Ge_x$ layer is selected to have a thickness below a critical thickness; and

covering said undoped epitaxial layer with a second material, wherein said second material is of a second conductivity type

15. The method of claim 14, further comprising the step of filling said trench with said second material.

16. The method of claim 14, further comprising the steps of:

producing said trench, wherein said trench has a sidewall and a bottom; and

doping said sidewall and said bottom with dopants of said first conductivity type.

17. The method of claim 14, further comprising the step of forming a smooth top surface for said photodetector, wherein said smooth top surface comprises:

a surface plane of said Si well;

a cross sectional surface band of said undoped epitaxial layer; and

a surface area of said second material.

18. The method of claim 14, further comprising the step of selecting said $Si_{1-x}Ge_x$ layer to be essentially pure Ge.

19. The method of claim 14, further comprising the step of reverse biasing said Si well with respect to said second material.

20. The method of claim 14, further comprising the step of selecting said first conductivity as p-type and said second conductivity as n-type.

21. The method of claim 14, further comprising the step of selecting said first conductivity as n-type and said second conductivity as p-type.

22. The method of claim 14, further comprising the step of selecting said second material from the group consisting of monocrystalline Si in epitaxial relation with said undoped epitaxial layer, polycrystalline Si, amorphous Si, polycrystalline SiGe, amorphous SiGe, polycrystalline Ge, amorphous Ge, and their combinations thereof.

23. The method of claim 14, further comprising the step of reverse biasing said Si well with respect to a monocrystalline Si body which contacts said Si well, wherein said Si body is selected to have said second conductivity type.